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SERIES OF RATIONAL TRIANGLES.

By SYLVESTER ROBINS, North Branch, New Jersey.

The following is the simplest method known to the writer of finding the dimensions of prime, integral, rational, scalene triangles in series.

PROBLEM: There is an infinite series of rational, scalene triangles in which there is a difference of 1 between the two short sides of every term, and the longest side is one less than double the shortest.

SOLUTION: Let x , $x+1$, and $2x-1$ represent the sides.

Then $2x.x(x-1) = \square$: $2(x-1) = \square$: $2x-2 = \square$.

$x = \frac{\square}{2} + 1 = 3 \quad 9 \quad 19 \quad 33 \quad 51 \quad 73 \quad 99 \quad 129 \quad 163 \quad 201 \quad 243 \quad 289 \quad 339 \quad 393 \quad 451 \quad \&c.$

$x+1 = 4 \quad 10 \quad 20 \quad 34 \quad 52 \quad 74 \quad 100 \quad 130 \quad 164 \quad 202 \quad 244 \quad 290 \quad 340 \quad 394 \quad 452 \quad "$

$2x-1 = 5 \quad 17 \quad 37 \quad 65 \quad 101 \quad 145 \quad 197 \quad 257 \quad 325 \quad 401 \quad 485 \quad 577 \quad 677 \quad 785 \quad 901 \quad "$

General expressions: $2n^2+1$, $2(n^2+1)$, $(2n)^2+1$.

PROBLEM: In a certain series of rational \triangle 's there is a constant difference of 2 between two sides, and the third one is 2 less than twice the shortest.

SOLUTION: Let x , $x+2$, $2x-2$, represent sides of \triangle : $2x.x.2(x-2) = \square$.

$x = \square + 2 = 3 \quad 11 \quad 27 \quad 51 \quad 83 \quad 123 \quad 171 \quad 227 \quad 291 \quad 363 \quad 443 \quad 531 \quad 627 \quad 731 \quad \&c.$

$x+2 = 5 \quad 13 \quad 29 \quad 53 \quad 85 \quad 125 \quad 173 \quad 229 \quad 293 \quad 365 \quad 445 \quad 533 \quad 629 \quad 733 \quad "$

$2x-2 = 4 \quad 20 \quad 52 \quad 100 \quad 164 \quad 244 \quad 340 \quad 452 \quad 580 \quad 724 \quad 884 \quad 1060 \quad 1252 \quad 1460 \quad "$

General expressions: $(2n-1)^2+2$, $(2n-1)^2+4$, and $2(2n-1)^2+2$.

PROBLEM: In an infinite series of rational, scalene \triangle 's, there is a difference of 8 in two of the sides, and the other one is 8 less than twice the shortest.

SOLUTION: Represent the sides by x , $x+8$, and $2x-8$.

Then $2x.x.8(x-8) = \square$.

$x = \square + 8 = 9 \quad 17 \quad 33 \quad 57 \quad 89 \quad 129 \quad 177 \quad 233 \quad 297 \quad 369 \quad 449 \quad 537 \quad 633 \quad 737 \quad \&c.$

$x+8 = 17 \quad 25 \quad 41 \quad 65 \quad 97 \quad 137 \quad 185 \quad 241 \quad 305 \quad 377 \quad 457 \quad 545 \quad 641 \quad 745 \quad "$

$2x-8 = 10 \quad 26 \quad 58 \quad 106 \quad 170 \quad 250 \quad 346 \quad 458 \quad 586 \quad 730 \quad 890 \quad 1066 \quad 1258 \quad 1466 \quad "$

General expressions $(2n-1)^2+2.2^2$, $(2n-1)^2+4^2$, $2\frac{1}{2}(2n-1)^2+2^2\frac{1}{2}$

PROBLEM: In an infinite series of rational, scalene \triangle 's, there is a difference of 9 in two of the sides, and the other one is 9 less than twice the shortest.

SOLUTION: $2x.x.9(x-9) = \square$: $2(x-9) = \square$: $x-9 = \frac{\square}{2}$.

$x = \frac{\square}{2} + 9 = 11 \quad 17 \quad 41 \quad 59 \quad 107 \quad 137 \quad 209 \quad 251 \quad 347 \quad 401 \quad 521 \quad 587 \quad \&c.$

$x+9 = 20 \quad 26 \quad 50 \quad 68 \quad 116 \quad 146 \quad 218 \quad 260 \quad 356 \quad 410 \quad 530 \quad 596 \quad "$

$2x-9 = 13 \quad 25 \quad 73 \quad 109 \quad 205 \quad 265 \quad 409 \quad 475 \quad 685 \quad 793 \quad 1033 \quad 1165 \quad "$

PROBLEM: In an infinite series of rational, scalene \triangle 's, there is a difference of 18 in two of the sides, and the other one is 18 less than twice the shortest.

SOLUTION: $2x(x-18)18x=\square: x=\square+18.$

$$x=\square+18=19\ 43\ 67\ 139\ 187\ 307\ 379\ 547\ 643\ 859\ 979\ 1243\ \&c.$$

$$x+18=37\ 61\ 85\ 157\ 205\ 325\ 397\ 565\ 661\ 877\ 997\ 1261\ \text{“}$$

$$2x-18=20\ 68\ 116\ 260\ 356\ 596\ 740\ 1076\ 1268\ 1700\ 1940\ 2468\ \text{“}$$

PROBLEM: In an infinite series of rational, scalene \triangle 's there is a difference of 25 in two of the sides, and the other one is 25 less than twice the shortest.

SOLUTION: $2x.x.25(x-25)=\square: 2(x-25)=\square.$

$$x=\frac{\square}{2}+25=27\ 33\ 43\ 57\ 97\ 123\ 153\ 187\ 267\ 363\ 417\ \&c.$$

$$x+25=52\ 58\ 68\ 82\ 122\ 148\ 178\ 212\ 292\ 388\ 442\ \text{“}$$

$$2x-25=29\ 41\ 61\ 89\ 169\ 221\ 281\ 349\ 509\ 701\ 809\ \text{“}$$

PROBLEM: In an infinite series of rational, scalene \triangle 's, there is a difference of 32 in two of the sides, and the other one is 32 less than twice the shortest.

SOLUTION: $2x.x.32(x-32)=\square: x-32=\square.$

$$x=\square+32=33\ 41\ 57\ 81\ 113\ 153\ 201\ 257\ 321\ 393\ \&c.$$

$$x+32=65\ 73\ 89\ 113\ 145\ 185\ 233\ 289\ 353\ 425\ \text{“}$$

$$2x-32=34\ 50\ 82\ 130\ 194\ 274\ 370\ 482\ 610\ 754\ \text{“}$$

PROBLEM: In an infinite series of rational, scalene \triangle 's, there is a difference of 49 in two of the sides, and the other one is 49 less than twice the shortest.

SOLUTION: $2x.x.49(x-49)=\square: 2(x-49)=\square.$

$$x=\frac{\square}{2}+49=51\ 57\ 67\ 81\ 99\ 121\ 177\ 211\ 249\ \&c.$$

$$x+49=100\ 106\ 116\ 130\ 148\ 170\ 226\ 260\ 298\ \text{“}$$

$$2x-49=53\ 65\ 85\ 113\ 149\ 193\ 305\ 373\ 449\ \text{“}$$

PROBLEM: In an infinite series of rational, scalene \triangle 's, there is a difference of 50 in two of the sides, and the other one is 50 less than twice the shortest.

SOLUTION: $2x.x.50(x-50)=\square: x-50=\square.$

$$x=\square+50=51\ 59\ 99\ 131\ 171\ 219\ 339\ 411\ 491\ 579\ \&c.$$

$$x+50=101\ 109\ 148\ 181\ 221\ 269\ 389\ 461\ 541\ 629\ \text{“}$$

$$2x-50=52\ 68\ 149\ 212\ 292\ 388\ 628\ 772\ 932\ 1108\ \text{“}$$

PROBLEM: In a certain series of rational \triangle 's there is a constant difference of 72 between two sides, and the third one is 72 less than twice the shortest.

SOLUTION: $2x.x.72(x-72)=\square: x-72=\square.$

$$x=\square+72=73\ 97\ 121\ 193\ 241\ 361\ 433\ 601\ 697\ 913\ \&c.$$

$$x+72=145\ 169\ 193\ 265\ 313\ 433\ 505\ 673\ 769\ 985\ \text{“}$$

$$2x-72=74\ 122\ 170\ 314\ 410\ 650\ 794\ 1130\ 1322\ 1754\ \text{“}$$

